REMARKS

This is in response to the Office Action mailed on June 27, 2006. Claims 1-17 are pending in the application and were rejected. With this amendment, claims 1, 2, and 4-9 are amended. The remaining claims are unchanged. No new claims are added and no claims are canceled from the application. Finally, a Response to a Requirement for Information under 37 CFR §1.105 is included.

Claims 4-9 were rejected based on 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Office Action states "the claims omit variables adequate variable definitions or usage description, therefore the claims are inadequate." With this amendment, the variables in each claim are defined so as to clarify claims 4-9. Support for the amendments can be found in various tables and supporting text throughout the application as filed. Applicants submit the claims themselves are clear, and that when read in context with the specification, one skilled in the art can make and use the invention.

Claims 1-17 were rejected under 35 U.S.C. 103(a) as being unpatentable over Green in view of Beaumont. Applicants have amended independent claims 1, 2, and 12 to highlight features not shown or suggested in Green and Beaumont or in the prior art. For example, claim 1 has been amended to include the features of "optimization processor means . . . for automatically generating a mixed integer programming model . . . wherein the optimization processor optimally awards transfer and leave request based on seniority of the employees." Also, claim 2 has been amended to include the feature of "said optimized solution having at least one of awards of said leave requests and awards of said transfer requests wherein the transfer and leave awards are based on seniority of the employees." Further, claim 12 has been amended so that "awards include at least one of transfer and leave awards based on seniority of the employees." Applicants respectfully submit that because the features of the claim are missing from Green and Beaumont and are not suggested in the prior art that such features would be missing from any proposed combination of the references.

For example, Green presents a system for facilitating the self-selection of vacation days

by employees. It essentially has employees queue up in a priority order and self-select their vacations from what's available when it's their turn. The system of Green manages the employees' vacation self-selection process but it does not determine optimal actual transfer or leave awards. Accordingly, Green does not meet the limitations of the amended claims such as "optimization processor means . . . for automatically generating a mixed integer programming model . . . wherein the optimization processor optimally awards transfer and leave request based on seniority of the employees" of claim 1, "said optimized solution having at least one of awards of said leave requests and awards of said transfer requests wherein the transfer and leave awards are based on seniority of the employees" of claim 2, and "awards included at least one of transfer and leave awards based on seniority of the employees" of claim 12.

Beaumont presents a mathematical model for determining how many staff to employ and the times at which work shifts should start. This model uses demand forecasts and service capacities to determine the quantity of staff required to service all demands within stated tolerances. The addition of cost factors allows the model to determine the best mix of employees versus contractors within its work force. Except for the use of a mixed integer program, it has absolutely no relation to the system disclosed in this application. Beaumont's system is completely different with unrelated objectives and constraints that solve completely different business problems. Accordingly, Beaumont does not teach the features of the amended independent claims.

Furthermore, Applicants respectfully submit that the prior art provides no suggestion to combine the references in the manner proposed in the Office Action in part because neither of the references or prior art recognize the problem facing the Applicants. The system of the present disclosure is fundamentally different from Green and Beaumont. A purpose of the present system is to determine the optimal award of transfer and leave requests. By manipulating the input parameters, the disclosed system may be rerun many times to generate a set of optimal award solutions from which one may be selected to best support the business' operations. Neither Green nor Beaumont can solve this award optimization problem; much less offer a means for solving it optimally many times. The coupling of Green's system with Beaumont's mixed integer program provides no insight on how to create a system to solve the transfer and leave request problem. One example is that Beaumont admits the sensitivity of the mixed integer

program to the coefficients in the model. For example, this is disclosed in the last sentence of the abstract. One of ordinary skill in the art would immediately discard Beaumont's mixed integer program in favor of pursuing a different model with different objectives and constraints.

The remaining claims 3-11 and 13-17 depend either directly or indirectly from independent claims 1, 2, or 12. Independent claims 1, 2, and 12 have been demonstrated to be patentably distinguishable from the prior art, as discussed above. The dependent claims 3-11, and 13-17, by virtue of their dependency, are also patentably distinguish from the prior art.

Accordingly, Applicants respectfully request removal of the rejections and for allowance and favorable action on the application. The amendments of this response are made only to expedite prosecution and are not to be construed as admission of any kind. Applicants reserve the right to pursue the original matter in subsequent applications.

Response to 37 CFR §1.105 Requirement for Information

This section of the response to the Office Action is directed to the Requirement under 37 CFR 1.1.05 to provide information believed reasonably necessary by the Examiner to the examination of this application. In preparing this response, Applicants have complied with their duty of candor and good faith under 37 CFR 1.56 to provide a complete and accurate response. To the extent that any of the answers to the information requirements of the Office Action are incomplete or nonexistent, Applicants submit that such information is unknown or cannot be readily obtained.

Publications Relied Upon to Draft Claimed Subject Matter

The Applicants are experts in the field of Operations Research and in the art of mixed integer programming. An Applicant has doctoral and master degrees in Operations Research from the University of Texas at Austin, is a co-author of at least six publications on optimization of integer problems, and holds a patent for a solution method for solving a specific integer optimization problem.

No particular publication was used by the Applicants to draft the claimed subject matter. The Applicants developed the described mixed integer model and the associated equations in response to the requirements articulated by the staff at Continental Airlines responsible for the management of flight attendants. The claims made by the Applicants describe a system for optimally processing flight attendant transfer and leave requests at Continental Airlines. This system may also be generalized to process any seniority-based transfer and leave award practice.

No materials or publications were used to develop the equations in claims 4-9. The Applicants developed the equations through trial and error, starting with different equations and eventually converging on those presented in the claims. After the equations had been developed, it was observed that they were applications of equations known as precedence constraints.

Precedence constraints are well known in the field of Operations Research. A precedence constraint establishes a relationship between two or more decisions. For example, suppose decision one answers the question, "Do I use a grey colored primer or a white colored primer on a wall I will paint?" Further, suppose decision two answers the question, "Do I paint the wall white or blue?" One can establish a relationship between the two decisions. In this example, a relationship can be, "I must paint the wall blue if I use the grey colored primer."

Thus precedence constraints use the outcome of one decision to compel the outcome of another decision. Typically, precedence constraints are used in machine scheduling problems where a job may be assigned to a subset of machines for a task depending on the machine that completed the previous task for the job. It should be noted that the use of precedence constraints is not limited to mixed integer programs; precedence constraints can be used in a variety of optimization models including linear, non-linear, and goal programming.

The equations in claims 4-9 apply the principles of precedence constraints to seniority-based award processing. In the opinion of the Applicants, the application of these principles and their use in an optimization model to maximize seniority-based awards is a novel invention. The Applicants are unaware of prior art that utilizes precedence constraints within optimization models for seniority-based award systems.

A List of Citations

The following are a few texts that provide foundational depth on operations research, mixed integer programming, combinatorial optimization, and linear programming.

Nemhauser, George L., and Laurence A. Wolsey, **Integer and Combinatorial Optimization**, John Wiley and Sons, New York, 1988.

Papdimitriou, Christos H., and Kenneth Steiglitz, **Combinatorial Optimization: Algorithms and Complexity**, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1982.

Lawler, Eugene L., **Combinatorial Optimization: Networks and Matroids**, Saunders College Publishing, Fort Worth, TX, 1976.

Hillier, Frederick S., and Gerald J. Lieberman, **Introduction to Operations Research, Fourth Edition**, Holden-Day, Inc., Oakland, CA, 1986.

Garey, Michael R., and David S. Johnson, **Computers and Intractability, A Guide to the Theory of NP-Completeness**, W. H. Freeman and Company, New York, 1979.

The following link provides this definition of mixed integer programming: http://glossary.computing.society.informs.org/index.php?page=M.html.

Mixed-integer program (MIP). Some of the variables are required to be integer-valued. Historically, this term implied the mathematical program was otherwise linear, so older papers (and some recent ones) mean this, but most now refer to the following:

MILP: Mixed integer linear program;

MINLP: Mixed integer nonlinear program;

MIQP: Mixed integer quadratic program.

Also see combinatorial optimization.

The following definition of precedence constraints can be found in this link: http://glossary.computing.society.informs.org/index.php?page=P.html.

Precedence constraint. When ordering objects, like jobs to be performed, this is a constraint that restricts the order: *i must precede j*, denoted i << j. If *order* really means time, and if the model has decision variables t_i and t_j to denote the start times of i and j, resp., this precedence constraint can be written as t_j >= t_i + T_i, where T_i is the time job i takes. On the other hand, a precedence constraint need not correspond to real time. For example, i << j could mean *if project j is not selected, we cannot select project i.* In that case, suppose the model has binary variables x_i and x_j, where x_i=1 means project i is selected, and x_i=0 means it is not selected. Then, the precedence constraint i << j is represented as: x_i <= x_j.

Citations and Copies of Publications Relied Upon to Develop Disclosed Subject Matter

As noted above, the Applicants did not rely on any publications to develop the disclosed subject matter. As experts in the field of Operations Research and in the art of mixed integer programming, the Applicants used trial and error to build a series of mathematical models to generate optimal solutions to Continental Airlines' flight attendant transfer and leave award process. It was through this trial and error process that the Applicants converged on the disclosed system and model that sufficiently and completely represents the transfer and leave award process.

Improvements of Claimed Subject Matter over Disclosed Prior Art

The seniority processing constraints in claims 4-9 reflect the application of the principles of precedence constraints to seniority-based award processing. One schooled in the field of Operations Research would have knowledge of precedence constraints. However, in order to

derive the equations in claims 4-9, one would also have to possess knowledge about seniority-based award processing and extraordinary skill in the art. The disclosed equations in claims 4-9 are novel applications of the principles of precedence constraints. They enforce the strictness of the nature of seniority-based decision making. The Applicants are unaware of any prior art that utilizes precedence constraints within optimization models for seniority-based award processing.

Products and Services Incorporating Claimed Subject Matter

The system disclosed in this application is the "FA Transfer and Leave Optimizer", a component of a larger system named "ManpowerSolver," developed by Caleb Technologies and delivered to Continental Airlines.

CONCLUSION

In the event a telephone conversation would expedite the allowance of the present application, the undersigned may be reached at 612-607-7340. If any fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees, including fees for any extension of time, to Deposit Account No. 50-1901 (Docket 20032-3009).

Respectfully submitted,

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